An Investigation of Mechanisms in Bonding and Failure of Thermal Spray Coatings

Completed Technology Project (2015 - 2018)

Project Introduction

The proposed project is an investigation of the mechanisms in bonding and failure of thermal spray coatings. The objectives for this project are as follows: establish an understanding of the mechanisms responsible for bonding, including metallurgical bonding and mechanical interlocking, and understand the mechanisms that dominate during coating failure. Understanding of bonding mechanisms will allow for optimization of the coating process to increase the strength of coatings as well as production of new combinations of coatings and substrates. Understanding the failure mechanisms of coatings allows one to tailor microstructures and optimize pre and post treatments to optimize coating performance. This investigation will be conducted through several steps. First is characterizing coating/substrate systems' stress state and dislocation densities using nanoindentation, electron backscatter and diffraction. Second is by inducing coating failure by several methods: surface indentation, interface indentation, and tensile testing. Characterizing the failed states and then comparing with initial states will provide insight into the aforementioned mechanisms. Finally, a cohesive zone finite element model will be utilized to model these behaviors and predict failure under different starting states. This project holds great significance to NASA because of the large requirements for specially engineered materials. Though the investigation is not explicitly creating a new kind of coating, it holds significance to the application of all coatings, including established and as yet undeveloped coatings.

Anticipated Benefits

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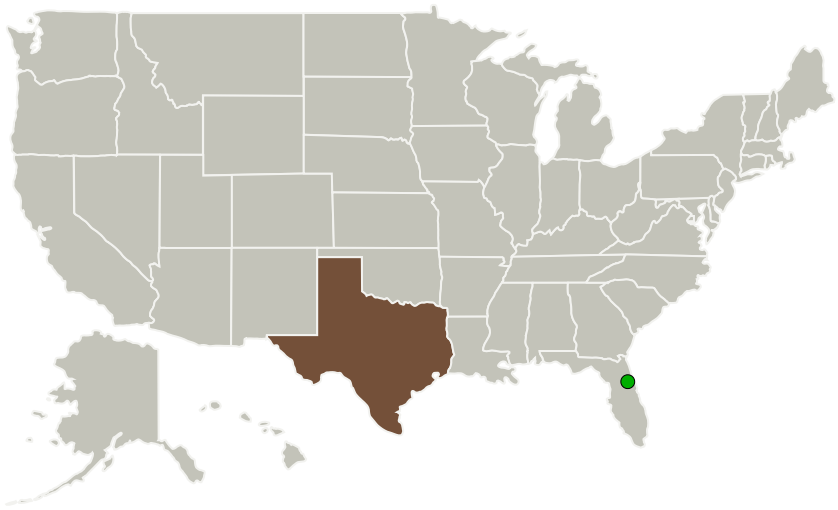
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
University of Houston	Lead Organization	Academia Asian American Native American Pacific Islander (AANAPISI), Hispanic Serving Institutions (HSI)	Houston, Texas
Kennedy Space Center(KSC)	Supporting Organization	NASA Center	Kennedy Space Center, Florida

Primary U.S. Work Locations
Texas

Project Website:

https://www.nasa.gov/strg#.VQb6T0jJzyE

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

University of Houston

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:

Hung D Nguyen

Principal Investigator:

Ken White

Co-Investigator:

Andrew D Robertson

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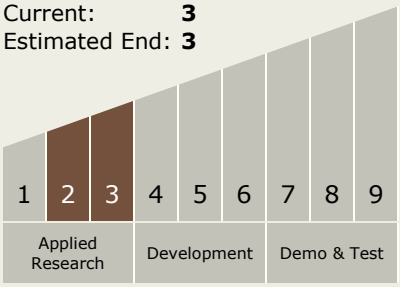
Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials
    - TX12.1.5 Coatings

Target Destination

Outside the Solar System